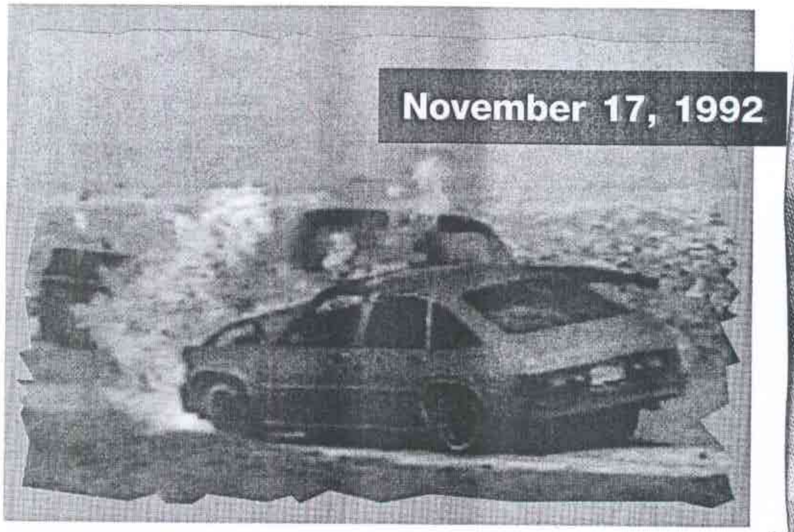
BY TOM McNICHOL

MASTERS of DISASTER

Why re-creating crises is a good business for Failure Analysis.



November 17, 1992

CRASH INCENTIVE: With advanced computer visualization and analysis techniques, Failure proved "Dateline NBC" used hobby rocket engines to ignite a GM pickup truck.

AP/Wide World Photos

ROGER MCCARTHY, CEO of the engineering consulting firm Failure Analysis Associates, is marveling over that greatest of all optical scanning systems, the human eye.

"If you look at the information bandwidth that comes through the human eye, that's four gigabaud," McCarthy bubbles with boyish enthusiasm. "Four billion baud! There's no computer in the world that can approach that. And then, the ability of the human brain to process 14 or 15 images a second and then make decisions based on that is so beyond computer capability today, it's just staggering."

Of course, even the human eye has limitations, a reality McCarthy confronts a few moments later when he unsuccessfully searches for something on his desk, which is a mad scientist's clutter of technical journals, old magazines, floppy disks, fountain pens and stray antique bullets from his extensive gun collection. But McCarthy quite literally is a man of vision. One of his firm's cutting-edge disciplines is high-tech visualization, using computer animation, video, and 3D imaging techniques to re-create complex accidents for people as though they had seen them with their own eyes. And seeing, McCarthy will tell you, is believing.

"When you can make a visual picture of the results of your investigation, the communication value is so incredibly increased it's not even an issue," McCarthy says. "It's a tremendous competitive advantage. The use of this will only increase exponentially."

Where Two Laws Meet

Failure Analysis inhabits the territory where the laws of physics meet Murphy's Law. The company was launched in 1967 by two Stanford engineering professors and three fellow researchers who were moonlighting as expert witnesses in product-liability cases and spun it into a business. Since then, Failure Analysis has grown into a large company with $65 million in billings last year, a dozen offices, 450 employees (including nearly 100 Ph.D.s) and an international reputation as the engineering world's Masters of Disaster. Failure Analysis has investigated thousands of motor vehicle accidents, airline crashes, fires, chemical explosions, oil spills, gas leaks and product failures, and has come up with explanations of why and how things went wrong. "Failure" isn't a bad word at this firm—it's a meal ticket. At headquarters in Menlo Park, Calif., employees routinely refer to the company simply as "Failure," and the Nasdaq-traded corporation has one of the more gutsy ticker symbols on the market: FAIL.

"We're the failures," McCarthy says with a grin. "That's what we do. We try to make companies learn the lessons from the history for which they've paid so dearly."

July 17, 1981

HOTEL HELL: When two walkways collapsed on the crowded lobby of the Hyatt Regency in Kansas City, killing 113 people, Failure's mathematical models pinpointed faulty construction, not "harmonic vibrations."

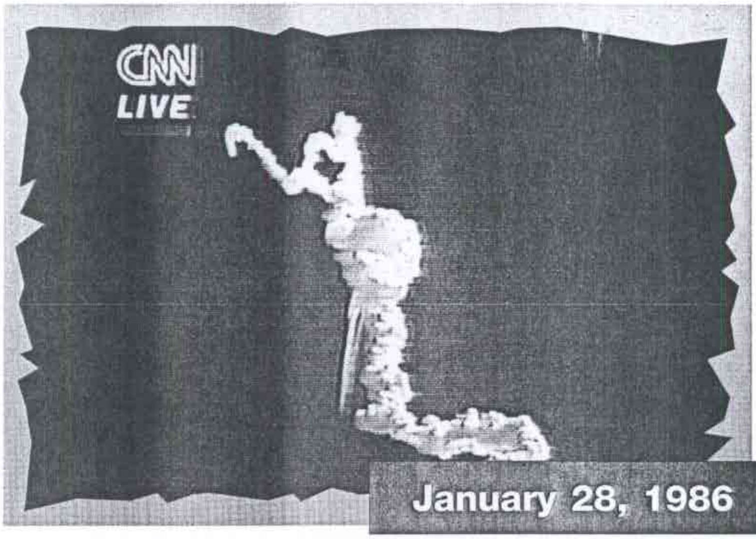
Failure Analysis is best known for its investigation of high-profile multimillion-dollar disasters. The company was called in to investigate aspects of the Exxon Valdez oil spill, the space shuttle Challenger explosion, the destruction of Kuwaiti oil wells during the Gulf War, the 1981 collapse of an aerial walkway at the Kansas City Hyatt Regency and dozens of airline disasters. But for every celebrated case, Failure investigates thousands of small accidents, involving everything from autos, all-terrain vehicles and construction equipment to coffeepots, vending machines and even horse-drawn buggies.

Failure usually enters the picture when there is a dispute over who or what is to blame for an accident, which in America translates to "see you in court." Typically, Failure is hired by insurance companies or attorneys representing large companies in product-liability lawsuits brought by individuals. Failure works on the side of Big Business for the same reason Willie Sutton robbed banks: That's where the money is. Failure's rates are at the top end in the industry. Hourly charges run from $60 to $550, averaging about $119 in 1993. Though Failure won't confirm it, employees estimate the biggest cases (complex airline crashes, large disasters) bill in the $400,000 range. And for good reason: The cost of a computer animation ranges from a few thousand dollars for a simple depiction of a car accident to $100,000 or more for a detailed 3D animation of a complex disaster.

Since so much of the company's work is involved in litigation, communicating the facts of a case persuasively is often as important as gathering and interpreting data. That's where Failure's visual engineering group comes in. Unlike most corporate divisions encouraged to visualize success, this group is charged with visualizing failure. Company headquarters houses a Sony D-2 digital editing suite equipped to assemble broadcast-quality video presentations for use in the courtroom. Putting together a persuasive courtroom video is often a balancing act, making good use of split screens, exploding graphics, moving and vanishing text and multiple camera perspectives, without letting the technology overwhelm the message.

"If you're showing a video to a jury, you have to keep it simple," says Erich Phillips, an expert in visual perception and lighting who left Failure as managing scientist in October to work for rival FTI. "The closer we can make it look to regular television the better, because that's what juries watch when they go home."

Animation is the latest and most expensive visual tool Failure offers its clients. The firm has seven Silicon Graphics 3D workstations and sophisticated software from Wavefront Technologies, used by many special-effects companies in TV and film work. The animation software grew out of programs written in the late 1970s for mechanical engineers to analyze stress in buildings and vehicles. As computer power increased, the long string of numbers produced by these programs could be plugged in as data points, turned into visual images and animated. Computer-generated images let engineers "see" inside an object, rotate it to observe it from different angles and peel away layers without damaging the part.



SHUTTLE SHOCK: After the Challenger explosion, Failure teams' postmortems dissected all of the complex vehicle's major systems.

Amazingly Accurate Animation

A complex 3D animation of an airline crash can be synched to a large data set, including information from the cockpit voice recorder, the digital flight-data recorder, and wind and weather instrumentation. Using a technique called texture mapping, in which a pattern is applied to an animation surface, Failure can produce 3D animations that are practically photo-realistic—brick buildings with textured patterns, wood surfaces that show grain.

Because of the complexity and high cost of animation, it's not suited to just any case, such as a simple car crash. But in some instances, animation has proved to be indispensable. In a case tried last winter, Failure produced a series of complex animations for Marriott, which was suing contractors over costly construction delays in the building of a new hotel in downtown Manhattan. The case turned out to be difficult to illustrate because the exterior of the building didn't reflect the true nature of the delays. The animation Failure produced showed the building slowly being constructed from the ground up, contrasting the original building schedule with the actual construction. A colored bar moved slowly up the building to show when each floor was completely finished, demonstrating that the interior lagged far behind schedule.

"It was one of the most complicated animations we've ever done," says Phillips. "We put every piece of steel in the right spot. It really blew the jury away. The other side didn't have any animation, just court boards."

For the jury, seeing was believing. They returned with a $26 million-plus-interest verdict in favor of Marriott.

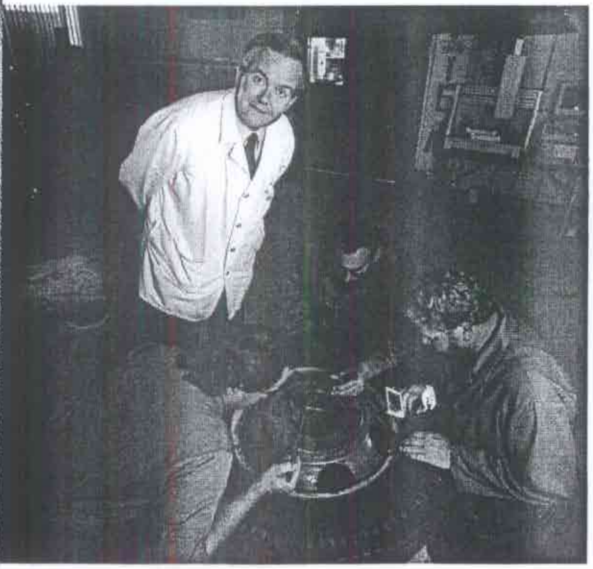
Because animations can be so persuasive, there are strict guidelines controlling their admissibility as evidence in a trial. An attorney must show that his animation has adequate factual foundation, and isn't just a pretty picture. "What if" animations are harder to clear than those purporting to show actual events, and the production can't be unfairly prejudicial to the other side in the case. Most animations of airline crashes, for example, stop at the point of impact, since showing the effects of the crash on passengers would have to prove relevant and not inflammatory. (But since Failure's teams usually represent manufacturers in such cases, a gruesome depiction would hardly help their case.) Animations can be "cross-examined," like any expert witness, with the data and assumptions of the animator called into question.

"Dateline NBC" saw its GM C/K pickup truck video explode in its face after Failure investigated the program's crash test, which aired in November 1992. In this case, Failure used one form of electronic visualization—digital image processing—to trump another—video.

Using a Kubota Titan workstation running a data visualization and analysis code (requiring 128 megabytes of RAM, 1.2 gigabytes in disk storage) developed by Failure called Integrated Part Evaluation System, in addition to less powerful but more flexible commercial software such as Adobe Photoshop, Failure processed a digitized photo of a part recovered from one of the trucks used in the crash tests. Although it appeared that all identifying marks on the part had been obliterated by months of exposure to the elements, computer image processing proved to be keener than the human eye. The enhanced photo clearly revealed the label "A8-3 SINGLE," a part number of a commercially available hobby rocket engine, which "Dateline" used in its crash tests to ensure that the trucks would ignite on impact. In

PETROLEUM BYPRODUCT: By analyzing the entire 987-foot hull of the Exxon Valdez and the reef where it ran aground, Failure precisely reconstructed the disastrous spill.

what some called the P.R. coup of the decade, General Motors displayed Failure's work at a triumphant news conference condemning NBC's work. The revelations led to a formal apology from the network, as well as the resignation of NBC News President Michael Gartner.



DR. OH NO!: Roger McCarthy, head of Failure: His company has thrived in a litigious age.

Not even Failure's regular opponents—usually plaintiffs' lawyers—accuse the company of deliberately falsifying data. Most suggest that there is a more subtle dynamic at work when an expert witness gives testimony.

"I'm sure the people at Failure Analysis believe everything they say, but you tend to see the world the way you make your money," says San Jose attorney Richard Alexander, who has opposed Failure Analysis while trying product-liability cases—on the plaintiffs' side. Alexander fully admits that *he's* an advocate who spins data in his clients' direction, but he claims that Failure, to some degree, does some spinning of its own, despite donning the cloak of scientific objectivity. "They give you what they have to on the left side, and what they have to on the right, and everything in the middle they spin their client's way."

Failure's employees are the first to admit that there's an inherent conflict between empirical science and advocacy. But they maintain that the company's primary asset is its reputation for accuracy and truthfulness, and they would rather lose business in the short term than risk sullying their integrity.

"Sometimes we have to tell clients bad news," says McCarthy. "But it's a tremendous economic advantage for them if they get that information first."

Of late, Failure's biggest problem has been adjusting to the recent recession in the legal profession. Failure grew fat feeding off the litigation boom in the go-go 1980s, doubling in size during the decade. When the cost-conscious '90s hit, most of the legal trade fell into an economic slump, and Failure has been feeling the pinch. Failure pocketed $4.5 million in profits for the fiscal year that ended in May 1993. But for the last seven months of 1993, Failure posted a net loss of $3.3 million, the first time it has been in the red. Through the first six months of 1994, the company chalked up a modest $166,000 profit.

Failure responded with an internal failure analysis of its own, resulting in an aggressive restructuring plan aimed at bringing in more business while controlling costs. The company has reduced its staff by 15% to 300 full-time employees, eliminated overtime pay and reduced executive compensation across the board. The directors' compensation was slashed by 30%, the CEO's by 25%, the president's and vice presidents' by 20%, and managers' from 5 to 15%. Employees have been given marketing training to hone their rainmaking skills, and the company even bought full-page institutional ads in selected publications. This from a company that used to crow that it never needed to advertise.

"In the heyday of litigation, the phone always rang," Failure President Michael Gaulke concedes. "But the landscape has changed. Now we're very much attuned to worrying about client relationships and forming strategic partnerships." Failure's belt-tightening may already be paying off. The small profit in the first half of 1994 came despite declining revenues, and the company expects to be in the black at year end. ASAP